MEMBRANE-SEPARATED, BIPOLAR MULTICELL ELECTROCHEMICAL REACTOR

ABSTRACT

A multicell assembly is constituted by alternately stacking two types of pre-assembled elements: a bipolar electrode holding subassembly and a membrane holding subassembly. The alternate stack of elements is piled over a bottom end element and the stack is terminated by placing over the last membrane holding element a top end electrode element. Each bipolar plate electrode holding element and each ion exchange membrane separator holding element includes a substantially similar rectangular frame piece, made of an electrically nonconductive and chemically resistant material, typically of molded plastic material, having on its upper (assembly) face grooves for receiving O-ring type gasket means, and having through holes and recesses in coordinated locations disposed along two opposite sides of the rectangular frame forming, upon completion of the assembling, ducts for the separate circulation of the negative electrolyte and of the positive electrolyte through all the negative electrolyte flow chambers and all positive electrolyte flow chambers, respectively, in cascade. ~~The bipolar reactor does not have inlet and outlet manifolds for the two electrolytes, on~~ the contrary, the electrolytes flow through the respective flow chambers in a zigzag path, that is essentially in hydraulic series or cascade mode instead than in hydraulic parallel mode. Therefore, by-pass current may only be "driven" by a relatively low voltage difference of about one-cell voltage.

Preferably, two orders of parallel flow channels are defined in felt electrodes to minimize pressure drops, all the parallel spaced channels of each order extend from a common orthogonal base channel formed along the respective inlet or outlet side of the chamber and terminate short of reaching the base channel of the other order. Each order defines a comb-shaped flow distributing channelwork the ~~parallel fingers of which interleave with the finger channels of the other order~~.